

## **International trade, employment, and earnings:**

### **Evidence from U.S. rural counties**

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#### **ABSTRACT**

Rural manufacturers in advanced countries are considered highly vulnerable to competition from international imports. Yet only limited empirical attention has been paid to the effects of trade on rural economies. This paper investigates the effects of international trade on rural manufacturing economies in the United States and compares the effects of trade pressures in rural versus urban areas. Our results indicate that lower export prices are associated with increased manufacturing employment and earnings in both rural and urban counties, while lower import prices are associated with reduced rural employment but increased urban employment. Greater export orientation is associated with lower employment and earnings in both rural and urban counties, while import orientation has mixed effects.

**Keywords:** economic globalization; regional development; U.S. regional growth.

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### **INTRODUCTION**

The effect of globalization on regional economies is a topic of growing interest in regional studies. Within advanced countries, globalization is associated with processes including rising levels of international trade and foreign investment, liberalization of national economic policies, and devolution of fiscal responsibilities from the national to regional levels. Each of these processes has been associated with increased regional income polarization and exacerbation of patterns of uneven development between rural and urban areas (Rodríguez-Pose and Gill, 2004; Glasmeier, 2002; Alderson and Nielsen, 2001; Fingleton, 1999; Kodras, 1997; Saeger, 1997). Indeed previous waves of globalization in the 19<sup>th</sup> century have been identified as the cause of already existing global disparities (Milanovic, 2003; Murshed, 2003). Yet our empirical knowledge of the effects of globalization on regional economies remains limited. In this paper, we explore the effects of one aspect of globalization — rising levels of international manufacturing trade — on rural economies in the United States.

Concerning the regional effects of international trade, several areas of literature directly address this issue. Traditional theories of trade and industrial location suggest that differing regional patterns of international trade and growth may stem from human and capital endowments, industry structure, and locational factors such as proximity to an international border (Rodríguez-Pose and Sánchez-Reaza, 2004; Leichenko and Coulson, 1999; Erickson and Hayward, 1992). Literature in the fields of industrial localization and ‘new economic geography’ further suggests that agglomeration economies associated with spatial concentration of industries

may provide reasons for regional specialization and trade, and that industrial sectors that are involved in trade tend to be more spatially concentrated than non-traded sectors (Storper, 1997; Krugman, 1991; Henry, 1999; Shelburne and Bednarzik, 1993). Sources of comparative advantage according to these agglomeration-based theories include existence of external economies of scale associated with both population and industry concentration (i.e., urbanization and localization economies), as well as the knowledge spillovers and institutional support structures that exist within these agglomerations (Martin and Sunley, 2003; Scott, 1998; Barnes and Ledebur, 1998).

According to traditional and new trade theories, rural economies may have several disadvantages vis-à-vis the international economy. Traditional endowment theory suggests that rural areas may have limited capacity to participate in international export markets because they are relatively less well-endowed with both human and physical capital and relatively more well-endowed with unskilled labor (Glasmeier and Leichenko, 1999; Leichenko, 2003). Given the specialization of advanced economies such as the United States in high-skill, human-capital intensive industries, the relatively larger endowments of rural areas in unskilled labor is a disadvantage in comparison with urban areas. With regard to import-competition, traditional trade theory suggests that rural regions may be especially vulnerable to the negative effects of increased involvement in trade. These regions, especially in the U.S. South, are often home to many low-wage manufacturing industries, which increasingly compete with low-wage manufacturing in other regions of the world (Conroy and Glasmeier, 1993; Wood, 1994; Rodrik, 1997; Glasmeier and Leichenko, 1996). Traditional location theory further indicates that remote location is a disadvantage for rural economies. Even though transport costs are becoming less

important relative to other production costs (Dicken, 2003), longer distances to international ports may nonetheless make rural products less competitive.

Agglomeration-based theories further suggest that rural firms are at a disadvantage because their lack of agglomeration economies associated with urbanization limits their ability to benefit from market-size advantages that accrue to urban firms. Moreover, the existing agglomerations of labor-intensive industries in rural areas (e.g., apparel and carpet manufacturing), rather than providing positive spillovers, may actually pose disadvantages to rural economies. High degrees of spatial concentration have been found to insulate rural industries from broader market signals, making them less likely to adopt new technologies needed to maintain competitiveness and thus more vulnerable to international competition following the removal of protective trade barriers (Fuellhart, 1999; Glasmeier, Thompson and Kays, 1993; Glasmeier, 2000).

This study investigates the effects of international trade on rural manufacturing economies in the United States and compares the effects of trade pressures in rural versus urban areas.<sup>1</sup> Among studies of the United States, much research attention has been directed toward investigation of the regional impacts of trade at the U.S. state and metro levels (e.g., Coughlin and Cartwright, 1987; Erickson, 1989; Erickson and Hayward, 1992; Noponen, Markusen, and Driessen, 1997; Leichenko, 2000). Many studies have also considered the effects of trade on employment and wages across different U.S. industries (e.g., Revenga, 1992; Bernard and Jensen, 1995; Feenstra and Hanson, 1996; Addison, Fox, and Rehm, 2000; Kletzer, 2001). Yet only limited attention has been paid to the effects of trade on the economies of U.S. rural regions. For rural manufacturing firms, the growth of international trade may provide new opportunities for export sales in high-tech industries such as electronics and scientific instruments, many of

which have begun to locate in rural areas. At the same time, however, rising low-cost imports may jeopardize jobs in traditional rural industries such as textiles and apparel. Given both the opportunities and challenges associated with international trade in rural areas, assessment of the rural economic impacts of foreign trade represents an important area for additional study.

Although we focus on rural economies in the United States, the implications of trade-related regional economic disparities reach well beyond U.S. trade policy and into the fabric of national and regional social policies in many advanced countries (Rodriguez and Gill, 2004; Silva and Leichenko, 2003; Glasmeier, 2002; Rodrik, 1997; Wood, 1994). The social consequences of globalization, such as unemployment, job insecurity, and shrinking welfare programs, have already engendered a significant political backlash (Sklair, 2002). Yet the magnitude of trade's impact on regional labor markets remains widely contested (Kapstein, 2000; Richardson, 1995). Examination of regional variation in trade-employment linkages not only contributes to basic knowledge about the effects of globalization at the regional level, but also helps to inform policymakers as they devise responses to assist displaced workers.

The next section of the paper reviews the empirical literature on international trade and regional economies in United States, focusing on different measures that have been applied to assess international trade pressures at the regional scale. The third section describes the construction of the county-level international trade database. The fourth and fifth sections present the empirical analysis. The concluding section summarizes the findings and discusses implications of the study for regional development and policy.

## **INTERNATIONAL TRADE AND REGIONAL ECONOMIES: THE U.S. EXPERIENCE**

Empirical studies of regional foreign trade involvement in the United States have drawn upon both traditional and new theories of trade and location. These studies have considered the role of traditional supply side factors such as endowments and locational factors in influencing regional trade patterns (Coughlin and Fabel, 1988; Erickson and Hayward, 1992), the linkages between patterns of industrial agglomeration and differential regional foreign export and import sensitivity (Shelburne and Bednarzik, 1993), and the combined role of supply and demand conditions in influencing regional involvement in international trade (Erickson and Hayward, 1991; Gazel and Schwer, 1998). Other studies have identified cities, states, and large Census regions that may stand to benefit or lose from trade liberalization efforts such as the passage of NAFTA (Yoskowitz, Giermanski, and Pena-Sanchez, 2002; Noponen, Markusen, and Driessen, 1997; Hayward and Erickson, 1995; Hayward, 1995). While these studies have broadened understanding of the differential foreign trade involvement of U.S. regions, states, and cities, only limited attention has been paid to the effects of foreign trade involvement in rural areas.

One study that considered rural trade involvement is that of Erickson et al. (1995), which examined the international export performance and patterns of export flows across counties in the Appalachian region.<sup>2</sup> This study found that international exports made a positive contribution to economic activity in Appalachian counties, but also suggested that Appalachia tends to lag the nation in shares of shipments and employment that are accounted for by foreign exports. Firm and industry-level case study research on rural areas provides additional evidence that rural areas may be especially vulnerable to competition from imports. Glasmeier et al. (1993) found that rural firms in both the South and the Midwest are unlikely to have the resources to adopt new

technologies and engage in capital investments needed to maintain international competitiveness.

A study by Jensen and Glasmeier (2001) of Appalachian firms found that these firms tend to have lower productivity levels and pay lower wages than similar plants located elsewhere.

National-level studies, which have linked international trade to the decline in relative demand for unskilled labor (Bernard and Jensen, 1995, 1997; Cline, 1997, 2001; Feenstra and Hanson, 1996; Krugman, 1995; Wood, 1998), provide further, indirect evidence that international trade may hurt rural economies. Urban-rural income and employment rate differentials have increased in the United States since the mid-1970s. Nissan and Carter (1999) found, for example, that the percentage of nonmetro income to metro income declined from 86 percent in 1973 to 77 percent in 1995. During the 1980s, in particular, nonmetro counties experienced less employment growth, and lower labor force participation relative to metro counties (Levernier, Partridge, and Rickman, 1998). This growing inequality between metro and nonmetro portions of the United States has been attributed, in part, to the erosion of low-skilled wages (Morrill, 2000; Glickman, 1998).

Although work that directly links international trade to rural economies is limited, there is nonetheless, a growing literature on the regional and urban impacts of international trade in the United States. One of the major challenges for these studies is to select appropriate measures of international trade pressures on regional economies. Detailed international trade data is collected at the national level. At the regional level, data is collected on manufacturing exports by both place of production and location of shipments. Concerning international imports, data is not compiled for import sales at the regional scale. Indeed, it is not so much the imports sold in a particular region that affect that region's economy. Rather, it is the sale of imported goods anywhere in the U.S. that may affect import-competing producers in a particular region. Thus,



the relevant issues associated with imports include whether a region's economy contains a large share of sectors that compete with imports, and the relative prices of those imported goods.

Three types of measures are typically used to gauge international trade pressures at the regional level. These include measures of export production (by both place of production and location of shipment), measures of industrial structure (import/export orientation of a region's industries), and measures of exchange rates at the regional level. The first measure, export shipments by place of production or port of shipment, has been widely applied to investigation of the direct role of foreign exports in regional, state, and urban economies (e.g., Kuehn and Braschler, 1986; Zech, 1986; Manrique, 1987; Coughlin and Cartwright, 1987; Erickson, 1989; Hayward, 1995; Leichenko, 2000; Leichenko and Coulson, 1999). These studies have generally found a positive association between foreign exports and regional production, though the effects of export growth on employment tend to be mixed. Leichenko (2000) and Leichenko and Coulson (1999), for example, found that growth of manufacturing exports reduces manufacturing employment at the state level, while at the same time increasing both manufacturing production and manufacturing capital investment.

The second measure of international trade at the regional level emphasizes industrial structure, relating a region's industrial mix to patterns of international trade across industries. Studies using this type of measure address issues such as the regional sources of international trade in different industrial sectors, and how regional economies with industry mixes that are more export or import-orientated perform in comparison to regions that are less trade-oriented (e.g., Drennen, 1992; Markusen, Nojonen, and Driessen, 1991; Nojonen, Markusen, and Driessen, 1997). Markusen et al. (1991), for example, apply measures of regional industrial structure in a shift-share analysis of the sensitivity of major U.S. regions to international trade

flows and productivity changes. The study results, which are reported for major Census regions, show large regional differences in employment sensitivity to changing trade patterns. Noponen et al. (1997) apply a similar approach to relate the industrial mixes of U.S. metro areas to patterns of international exports and imports, demonstrating that the effects of metro involvement in trade are highly variable, with some cities benefiting from export expansion, while at the same time, other cities have experienced job losses as the result of growing imports.

The third measure of regional involvement in trade considers how exchange rate fluctuations affect regional economies. Regional exchange rates are constructed by linking a region's industrial mix to the exchange rates in the source countries (for imports) and destination countries (for exports) of goods in the same industries. These measures are used as a proxy for the effects of changing prices of export and import goods at the regional level (e.g., Branson and Love, 1987; Carlino, Cody and Voith, 1990; Carlino, Voith and Cody, 1994; Cronovich and Gazel, 1998; Bernard and Jensen, 2000; Goldberg and Tracy, 2000). Results of the exchange rate studies are quite mixed. For example, Branson and Love (1987), using quarterly data from 1970 to 1986, find significant exchange rate effects in 35 states, while Carlino et al. (1990), using quarterly data for the period from 1972 to 1986, find significant effects in only 11 states. Cronovich and Gazel (1998) develop a more sophisticated, regionally sensitive exchange rate measure, based on both industrial structure of states and the foreign destination of a state's exports. Their results suggest that exchange rates indeed play a significant role in accounting for export patterns across states.

The above empirical work has provided important insights into the effects of international trade on regional economies. With the exception of the study of Appalachia by Erickson et al. (1995), however, the impacts of trade on U.S. rural economies has not been addressed on a large,

cross-sectional scale. There has also been only limited attention to the regional effects of international imports. This study addresses those issues by examining the effects of both exports and imports on the economies of U.S. rural areas and by comparing the effects of trade in rural versus urban areas. Because the goal of the study is to look broadly at the effects of trade on regional economies, we draw on the latter two approaches described above to develop measures of the price and structural effects of trade. As described in the next section, price effects are measured based on changes in exchange rates in the county's export and import-competing industries, while structural effects are measured based on the export and import orientation of a county's industry mix.

### **CONSTRUCTION OF THE COUNTY-LEVEL TRADE DATABASE**

Construction of the county-level international trade database combined national-level data on U.S. exchange rates, U.S. industrial exports by country of destination, and U.S. industrial imports by country of origination, with county-level data on manufacturing export shipments and shares of industrial production by 4-digit sector. The national export and import data were obtained from the databases developed by Robert Feenstra (1996; 1997). The exchange rate data were obtained from the *International Financial Statistics* database (International Monetary Fund, 2002). The county level manufacturing data were calculated using the Longitudinal Research Database of U.S. Census (LRD). The LRD contains data on total shipments, foreign exports and other variables for all manufacturing firms included in the U.S. *Annual Survey of Manufactures* and the U.S. *Census of Manufactures* for the period between 1967 and 1997.<sup>3</sup> Confidentiality concerns preclude public release of the LRD data. For this reason, the sorting, processing, and

compilation of the county trade database, and the subsequent data analysis, took place at the Census Bureau, Regional Data Center (RDC) laboratory in Washington, D.C.<sup>4</sup>

### *Trade Exchange Rate Measures*

Exchanges rates provide a proxy for the prices of exports from a county and for the prices of imports competing with goods produced in a county. The county-level exchange rates were constructed using a procedure based on Bernard and Jensen (2000). For county export exchange rates, the first step entailed calculation of an export exchange rate for each 4-digit SIC industry as the weighted sum of real exchange rates indices (U.S. dollar/foreign currency)<sup>5</sup> across countries weighted by each country's share in exports in the industry during that year:

$$1. \text{ EXCHEX}_i = \sum \text{EXP}_{\text{ctry},i} / \text{EXP}_i * \text{EXCH}_{\text{ctry}}$$

The second step used the above industry exchange rates to calculate county exchange rates. The county export exchange rate is the weighted sum of 4-digit SIC industry export exchange rates weighted by the share of the 4-digit SIC industry in total manufacturing exports from the county in that year:<sup>6</sup>

$$2. \text{ Export\_Exch}_{\text{cty}} = \sum \text{EXP}_{\text{cty},i} / \text{EXP}_{\text{cty}} * \text{EXCHEX}_i$$

The import exchange rate for a county is constructed using a similar two-step process. The 4-digit SIC industry import exchange rates are the sum of real exchange rates indices (U.S. dollar/foreign currency) across countries weighted by each country's share in imports in the industry during that year:

$$3. EXCHIM_i = \sum IMP_{ctry,i} / IMP_i * EXCH_{ctry}$$

County import exchange rates are constructed using the weighted sum of the industry import exchange rates with the weights given by the share of the industry in total shipments from the county in that year:<sup>7</sup>

$$4. Import\_Exch_{cty} = \sum TVS_{cty,i} / TVS_{cty} * EXCHIM_i$$

#### *Trade Orientation Measures*

The trade orientation measures provide an indication of the export and import orientation of the industries in which a county's economy is specialized. The measures are similar to those used by Addison et al. (2000) to investigate the effects of trade on job displacement. Unlike Addison et al. (2000), however, the measures are not intended as direct "quantity" measures of trade. Rather, they are intended as measures of the degree to which a county's exporting and import-competing industries are internationally-oriented and face international competitive pressures.

Construction of the county export and import orientation measures also entails a two-step process. For exports, the national export orientation of each 4-digit SIC industry is first calculated as the value of export shipments in the industry divided by the total value of shipments in that industry:

$$5. EXPOR_i = EXP_i / TVS_i$$

Next, export orientation for a county is calculated as the weighted sum of EXPOR with the weights given by the share of the 4-digit SIC industry in total export shipments from the county:

$$6. \text{Export\_Orient}_{cty} = \sum \text{EXP}_{cty,i} / \text{EXP}_{cty} * \text{EXPOR}_i$$

The calculation for imports is similar to that for exports. The national import orientation of each 4-digit SIC industry is calculated as the total value of import shipments divided by the total value of shipments in that industry that is available in the U.S. market (i.e., U.S. shipments plus imported shipments minus export shipments):

$$7. \text{IMPOR}_i = \text{IMP}_i / (\text{TVS}_i + \text{IMP}_i - \text{EXP}_i)$$

Import orientation for a county is then calculated as the weighted sum of IMPOR with the weights given by the share of the industry in the total shipments from a county:

$$8. \text{Import\_Orient}_{cty} = \sum \text{TVS}_{cty,i} / \text{TVS}_{cty} * \text{IMPOR}_i$$

Taken together, the exchange rate and trade orientation measures provide a gauge of external trade pressures at the county level for the time period from 1972 through 1994.<sup>8</sup> Before proceeding with the analysis, two limitations of the trade dataset should be noted. First, because the database is limited to the manufacturing sector, it does not capture the contribution of raw agricultural products or services to regional trade.<sup>9</sup> Nevertheless, because manufacturing

accounts for majority share of U.S. trade —approximately 60 percent of the value of U.S. international exports and 70 percent of the value of U.S. international imports— it remains a vital sector for investigation of regional trade impacts.<sup>10</sup> Second, the database does not use data on the trade destination of goods at the regional level, as in the state-level work of Cronovich and Gazel (1998). Instead, the exchange rate measures are based on a 4-digit SIC analysis, which relates 4-digit SIC production and export patterns to origins of imports and destinations of exports at the national level for 4-digit SIC industries.

### **MODELING APPROACH**

The above county-level trade measures allow us to evaluate the effects of international trade pressures on county manufacturing economies. As such, we model county manufacturing employment and county manufacturing earnings per worker over time as a function of a set of basic explanatory variables along with the above exchange rate and trade orientation measures. Our inclusion of a set of international trade indicators in a regional growth model is in a vein similar to the work of Erickson et al. (1995) and Markusen et al. (1991). An important difference, however, is that those approaches entailed application of dynamic shift share methods, and our application involves use of panel regression analysis, which captures both direct and indirect effects of trade and other variables on manufacturing economies.

Our regression model is similar in form to the models used in other regional trade studies to gauge the regional effects of trade over time, while controlling for basic explanatory variables (e.g. Coughlin and Cartwright 1987; Leichenko and Erickson 1997; Sun 2001). The basic form of the model of manufacturing employment may be represented as:

9. *manufacturing employment = fn(endowments, agglomeration economies, international trade exchange rates, international trade orientation)*

The dependent variable in the employment model is the log of county manufacturing employment ( $Employment_{cty, t}$ ). The explanatory variables, all of which are lagged by one period to minimize problems of endogeneity with the dependent variable, reflect the endowment and agglomeration theories discussed earlier, as well as the trade indicators detailed above.

Endowments are represented by the log of county manufacturing employment in the prior year ( $Employment_{cty, t-1}$ ), an indicator of past economic conditions in the county.<sup>11</sup> Agglomeration economies are represented by manufacturing share of total employment in the county ( $Manuf\_share_{cty, t-1}$ ) and by population density in the county ( $Pop\_dens_{cty, t-1}$ ). Manufacturing share, which reflects a region's overall specialization in manufacturing, is intended as a general measure of economies of localization, while population density is intended as a broad proxy for economies of urbanization. Both endowments and agglomeration economies are expected to have positive effects on manufacturing employment.

The trade exchange rate and trade orientation variables include county export exchange rates ( $Export\_Exch_{cty, t-1}$ ), county import exchange rates ( $Import\_Exch_{cty, t-1}$ ), county export orientation ( $Export\_Orient_{cty, t-1}$ ), and county import orientation ( $Import\_Orient_{cty, t-1}$ ). The use of one year lags is especially appropriate for the trade variables because trade pressures (i.e., changing exchange rates and structural shifts) are not expected not have an immediate impact on regional economies (Cronovich and Gazel, 1998; Leichenko and Erickson, 1997). Concerning the expected signs of the trade variables, export exchange rates and import exchange rates are both expected to have a positive effect on county employment. When there is a depreciation of the U.S. dollar (i.e., an increase in the U.S./foreign exchange rate), U.S. exports become



relatively cheaper and goods imported into the U.S. become relatively more expensive.<sup>12</sup> We would expect that cheaper exports would result in more export shipments and hence increased employment in a county. For imports, we would expect that higher prices for imported goods that compete with the goods produced in a county would benefit producers in a county and lead to increased employment. By the same token, if relative import prices fall (i.e., the import exchange rate falls), we expect that counties containing industries that face substantial competition as result of cheaper imports would experience a decline in employment.

The expected relationship between export orientation and employment is also positive. A higher degree of export orientation suggests that a county is specialized in highly export-oriented industries. Because export-oriented industries have larger employment multipliers (Bernard and Jensen, 1995; Webster et al., 1990), we expect export orientation to have a positive effect on county manufacturing employment. Finally, the expected sign on the import orientation variable is negative. A high value on the import orientation measure implies that a county is specialized in industries that face a high degree of competition from imports. As a result of these international competitive pressures, highly import-oriented counties would be expected to have lower manufacturing employment.

The manufacturing earnings model takes a similar form:

10. *manufacturing earnings* = *fn(endowments, agglomeration economies, international trade exchange rates, international trade orientation)*.

The dependent variable in the earnings model is the log of real earnings per manufacturing worker (*Earnings*<sub>*t*</sub>). The explanatory variables are identical to those used in the employment model except that endowments are represented by manufacturing earnings levels

during the prior year ( $Earnings_{t-1}$ ). The expected signs on the explanatory and trade variables are the same as those in the manufacturing employment models.

The employment and earnings models were estimated for all rural (nonmetro) counties, all urban (metro) counties, and all U.S. counties combined. The models were then estimated for rural (nonmetro), urban (metro), and all counties in each of the nine Census regions.<sup>13</sup> Differing industrial structures in the various regions suggest that regions may have different relationships to the international economy and thus may merit separate analysis (Markusen, Noponen, and Driessen, 1991; Erickson and Hayward, 1991; Leichenko, 2000). All of the models were estimated with individual (county) and time-period (year) fixed effects. The fixed effects were calculated by subtracting the mean for each county (individual effect) and the mean for each time period (year effect) from each observation. The individual fixed effects help to account for factors that do not vary over time across counties – e.g., locational variables. The time-period fixed effects account for factors that may affect all counties such as business cycles, oil price shocks, and so forth, during any given year.

Prior to estimation of the final models, several types of specification tests were performed including unit root tests, tests for cointegration, and tests for the appropriate lag length.<sup>14</sup> The unit root tests are based on the method developed by Pedroni (1999). The tests found little evidence of unit roots in either the employment or earnings models.<sup>15</sup> The models with no unit roots were estimated in levels. In those instances where unit roots were found, further tests for cointegration were performed. In those cases where unit roots were present without cointegration, the models were estimated in first-differences. In cases where there were unit roots with cointegration, the model was estimated in levels.

Lag length tests were performed using the SBC methods on all model groups. The maximum lag length considered was three years. Results of the tests suggested that the manufacturing employment models should be run with 1 lag. For the manufacturing earnings, 1 lag was indicated for the combined models of all counties, all urban counties, and all rural counties, but 3 lags were indicated for all of the Census region models.<sup>16</sup>

One limitation of the modeling approach is that the analysis is limited to ‘own county’ effects of trade orientation and exchange rate movements. In particular, we are looking at how exchange rates and trade orientation of a county’s industries directly affect manufacturing employment and manufacturing earnings in that county. As such we are focusing on the effects of external trade pressures within a county, but we are not considering the effects of trade pressures in one county on the economies of other counties.<sup>17</sup>

## **EMPIRICAL RESULTS**

Prior to examination of the modeling results, we briefly consider patterns of change in manufacturing employment and earnings over the study period.

### *Manufacturing Growth Patterns*

County time-series data on manufacturing employment, manufacturing earnings per employee, manufacturing employment shares, and population density were obtained from REIS (U.S. Census, 2001). Table 1 illustrates the distribution of population and manufacturing employment across the rural and urban portions of the United States and across different Census regions in 1995 (the last year of the study period). Rural areas accounted for 20 percent of the U.S. population in 1995 and 23 percent of U.S. manufacturing employment. Examination of the population figures across the different Census regions reveals that some regions are much more

“rural” than others in terms of population – especially the Southcentral, Great Plains, and Mountain West regions, each of which had a nonmetro population share of close to 40 percent in 1995. Some regions also have more rural manufacturing bases than others. The Southcentral, Great Plains, and Southeast regions all stand out as having a large share of manufacturing employment located in nonmetro areas. In the Great Plains, however, the manufacturing share in rural areas is slightly lower than the population share in rural areas. Not surprisingly, the West Coast, the MidAtlantic, and New England stand out as the most metropolitan regions, with lower nonmetro population and manufacturing employment shares than the other regions.

Table 2 and figure 1 present evidence of changes in manufacturing employment across the regions and by rural and urban portions of each region over the study period. Examination of figure 1 reveals dramatic differences across the Census regions in manufacturing employment patterns. The three regions comprising the “Industrial Heartland” (New England, MidAtlantic, Great Lakes) lost substantial amounts of manufacturing employment in both absolute and percentage terms over the study period. These drops reflect the widely recognized de-industrialization of the U.S. Northeast. The other regions of the country experienced gains in manufacturing employment over the study period, with the largest percentage gains occurring the Mountain West and Southwest. Across the rural portions of each region, employment patterns are somewhat different. With the exception of the MidAtlantic, the rural portions of all of the Census regions gained manufacturing jobs. This pattern suggests that it was the urban areas of the Industrial Heartland that endured most of the manufacturing job losses over the study period.

Real earnings per manufacturing worker and real earnings growth also varied across the Census Regions during the study period (Table 3 and figure 2). In 1995, regions with the highest average earnings per manufacturing worker included the Industrial Heartland areas of New

England, the MidAtlantic and the Great Lakes. These patterns of relative wage rigidity (despite dramatic job losses) are likely reflective of more unionized and more skill-intensive manufacturing in these regions. All of the regions experienced gains in real earnings per worker over the study period (figure 2), with the highest percentage gains occurring in the Southeast and Southcentral regions (both traditionally lower wage areas), closely followed by New England and the MidAtlantic. The smallest earnings gains occurred in the Mountain West and West Coast, indicating that growth of manufacturing jobs in these regions was not accompanied by commensurate growth in earnings per worker.

Our panel regression analysis allows exploration of the significance of international trade pressures in accounting for these observed changes in manufacturing economies while controlling for other factors.

### *Regression Results*

*All U.S. Counties.* Table 4 presents the regression results for rural counties, urban counties, and all U.S. counties combined. As expected, our lagged control variables representing endowments and agglomeration have positive and significant impacts on county manufacturing employment and county manufacturing earnings. The only exception is the negative and insignificant manufacturing share variable in the earnings model for urban counties. These results conform to our expectations that employment and earnings are largely a function of past levels in these variables (existing endowments), as well as agglomeration economies associated with both urbanization and localization.

Concerning the trade variables, our findings are more mixed. In general, the magnitudes of the trade variables are small in comparison with the other variables, indicating that changes in exchange rates and trade orientation have relatively smaller overall effects on county

manufacturing that do changes in any of the basic explanatory variables.<sup>18</sup> This finding is consistent with other research that suggests that domestic economic effects tend to outweigh the effects of international trade on regional economies (Markusen, Noponen, and Driessen, 1991; Leichenko, 2000). Nonetheless, the signs and significance patterns of the trade variables provide important clues into the impacts of international trade on regional economies, effects that are likely to increase in magnitude over time, as economic globalization leads to rising trade shares of total U.S. production.

The export exchange rate variables, which represent proxies for the prices of international export goods from a county, are generally found to have the expected, positive effects. The positive and significant coefficient on the export exchange variable in all of the employment and earnings models suggests that lower prices for export goods produced in a county are associated with higher employment and higher earnings in that county. (A higher value for the US/foreign export exchange rate implies that the U.S. dollar is weaker and hence U.S. export prices are relatively lower.) This positive export effect is consistent across rural counties, urban counties, and all counties combined.

With regard to import exchange rates, the effects on earnings are also consistent with our expectations. The positive and significant coefficient on the import exchange variable in all of the earnings models indicates that lower prices for the imported goods that a county competes with result in lower earnings for all counties, urban counties and rural counties. (A lower value for the U.S./foreign import exchange rate implies that the U.S. dollar is stronger and import prices are relatively lower.) In the employment models, however, the effects of import prices vary between rural and urban areas. In the rural employment model, the positive and significant coefficient on import exchange rates indicates that lower prices for imported goods result in

lower employment in rural counties. However, in the urban and all county employment models, import exchange rates have a negative and significant effect, suggesting that lower import prices result in higher employment. One possible explanation for the seemingly counter-intuitive, positive effects of cheaper imports in urban areas is that these effects reflect imported input purchases, whereby cheaper imported inputs help urban manufactures to maintain price competitiveness. Urban counties with higher-end manufacturing production are likely to be more reliant on imported inputs in their industries, and hence lower import prices would be beneficial. By contrast, rural counties are more likely to be in direct competition with imported products in their industries and thus are more likely to be hurt by lower prices for imported goods.<sup>19</sup>

Turning to the effects of trade orientation, the findings indicate that higher degrees of trade orientation, particularly export-orientation have negative effects. In all three employment models, export orientation has a negative and significant effect. This result suggests that counties with exporting industries that are more internationally-oriented tend to have lower manufacturing employment. Export orientation also has a negative sign in the earnings models, but the effect is significant only in the rural model. This result indicates that higher degrees of export orientation for rural county manufacturing firms are associated with lower earnings. The negative effects of export-orientation contrast with our expectation that export-oriented industries would have higher employment and higher earnings, but is, in fact consistent with work by Bernard and Jensen (1999) and Erickson et al. (1995) which demonstrated that export-oriented firms produce at higher levels of capital intensity and have higher shipments per worker, and hence lower overall employment levels. It is also consistent with industry level studies, which have demonstrated that greater involvement in the international economy is associated with high degrees of production efficiency (Baldwin and Caves, 1998).

The import orientation effects are more varied and tend to be less consistently significant. As was the case with export orientation, import orientation is found to have a negative effect on employment, and this effect is significant in the urban and all county models. Interestingly, import orientation has a positive effect on earnings in all three cases, and this effect is significant across rural counties and all counties. While counter to our initial expectations, the mixed import findings are also consistent with the findings of other studies (Bernard and Jensen, 2000; Feenstra and Hanson, 1996). Feenstra and Hanson (1996), for example, found mixed effects of imported inputs on employment and earnings for blue collar workers across different manufacturing sectors.<sup>20</sup>

*U.S. Census Regions.* The results for the regional models were generally similar to the results for the combined models. We therefore limit our discussion of the regional models to the rural and urban portions of each Census region.<sup>21</sup> The regional employment results (Table 5) are surprisingly consistent across the regions and generally follow the same patterns for sign and significance of the coefficients as the combined rural and urban results presented above. Focusing on the trade variables, the export exchange rate variables have the expected positive effect on manufacturing employment in nearly all cases. Export exchange rates have a positive sign in all cases (i.e., cheaper exports are associated with higher employment), and these effects are statistically significant in 10 out of 18 models. Import exchange rates have mixed effects, with positive signs in most of the rural models but negative signs in most of the urban models. These effects, which are statistically significant in 7 of the models, imply that cheaper imports (lower import exchange rates) are generally associated with lower employment rural regions, but higher employment in urban regions. One interesting exception is rural New England, where the import exchange rate has a negative and significant effect. This result suggest that manufacturers



in rural New England, like their urban counterparts, tended to be hurt by increased prices for imported goods.

The trade orientation effects across rural and urban counties by region also generally follow the sign patterns seen in the combined analyses. Higher degrees of export orientation in the industries in which a county's export producers are concentrated is generally associated with lower levels of employment, and these negative effects are statistically significant in most cases. Interestingly, the exception is again rural New England, where higher degrees of export orientation have a positive and statistically significant effect on manufacturing employment. The results for import orientation across rural and urban counties are mixed and are generally not statistically significant, reinforcing our conclusion from the aggregate analysis that import orientation plays a less important role in determining levels of county manufacturing employment.

Table 6 presents the sign and significance patterns for the coefficients in the earnings models across the rural and urban counties in each Census regions. Recall that these models contain three lags for each explanatory variable. Although the individual lagged coefficients in the models are less likely to be statistically significant due to correlations between the lags of each variable, the sign patterns for the dominant coefficients (i.e., the coefficients with largest effect among the three lags) are nonetheless consistent with the results for the combined models. Focusing again on the trade variables, export and import exchange rates generally have a positive sign pattern for the dominant lag (identified in bold in Table 5) in both rural and urban regions. This reinforces our conclusion that cheaper exports are generally associated with higher earnings while cheaper imports are associated with lower earnings. Concerning trade orientation, the

dominant lag on export orientation is again generally negative for earnings in both rural and urban counties, while import orientation has mixed effects.

## **CONCLUSIONS**

Economic globalization is thought to produce both winners and losers across countries and across different regions within each country (Conroy and Glasmeier, 1993; Deardorff and Stern, 2000; Kapstein, 2000; O'Brien and Leichenko, 2003). Within the United States and other advanced countries, rural regions are often characterized as potentially “losing” regions because they are home to many low-wage, import-competing manufacturers (Wood 1994; Glasmeier and Leichenko, 1996, 1999). This study investigated the effects of trade on manufacturing employment and manufacturing earnings across counties in the United States. Rural county effects were compared to the effects in urban counties and all counties combined for the country as a whole and across the major economic regions.

Our results suggested that international trade involvement has significant, but mixed effects on rural and urban economies. The effects of exchange rate movements in rural areas generally conformed to our expectation that cheaper U.S. exports lead to higher levels of employment and earnings in rural areas, while cheaper imports lead to lower levels of employment and earnings in rural areas containing import-competing industries. With the exception of rural New England, the exchange rate effects were generally consistent across all rural counties and across rural counties located in the different Census regions. In urban areas, we found that the exchange rate effects of exports were also consistent with our expectations, but the exchange rate effects of imports were mixed. Cheaper exports were found to be associated with higher levels of manufacturing employment and earnings in urban counties. Cheaper

imports were found to be associated with lower levels of urban earnings, but higher levels of urban employment. This positive import employment effect in urban areas, which ran counter to our expectations, may reflect the fact that urban-based manufacturers tend to be concentrated in more advanced industrial sectors which rely more heavily on imported inputs, and thus are hurt by rising import prices.

The effects of trade orientation were also somewhat unexpected. Export orientation was found to have negative effects on employment and earnings in both rural and urban areas. These findings, which were generally consistent across the Census regions, ran counter to our initial hypothesis that higher degrees of export orientation would be associated with higher employment and earnings. These results are, however, consistent with the findings of other studies which have suggested that participation in international markets is associated with greater industrial turbulence for manufacturing industries and with reduced manufacturing employment (Baldwin and Caves, 1998; Leichenko and Coulson, 1999). The results for import orientation were less consistent, displaying mixed and often insignificant effects in both the combined models and across the different Census regions. Inconclusive or mixed signs on imports have also been found in industry-level studies of the effects of imports on employment and wages (Bernard and Jenson, 2000; Feenstra and Hanson, 1996).

Concerning implications for regional development and policy, our results suggest that the regional impacts of trade are complex and are not necessarily consistent with conventional wisdom. On the export side, promotion of foreign exports is frequently cited as a major avenue for economic growth at the regional level (Norton, 1998; Rondinelli, Johnson, and Kasarda, 1998). Our findings raise questions about the implications of such a strategy in both rural and urban areas. While lower export prices indeed appear to promote growth in regional employment

and earnings, increased levels of export-orientation in a county's industries are associated with reductions in regional employment and earnings. This result, which likely reflects greater competitive pressures on firms in export-oriented sectors, implies that efforts to attract firms in industries that are highly export-oriented —precisely the type of firms that are typically targeted in industrial recruitment efforts— may not have the desired employment-enhancing effects.

On the import side, our results indicate that concerns about price-related import competition are valid in rural areas: lower import prices were found to be associated with lower levels of both employment and earnings across rural counties. Furthermore, the mixed and often insignificant effects of import orientation in rural areas suggests that rural economies may have more to fear from import price competition than from orientation of their industries toward import competing sectors. For urban counties, by contrast, where lower import prices were associated with higher levels of employment, policies that result in higher import prices (e.g., the recent round of U.S. steel tariffs) appear to pose more of an economic threat than import price competition.

Despite contemporary efforts to label the effects of globalization as either positive or negative (see Dicken 2003), the evidence presented here suggests that blanket judgments fail to account for differing regional dynamics. The complex nature of regional trade-employment linkages presents a significant challenge to national efforts to identify and compensate losers in liberalized labor markets. Both trade restrictions (via higher import prices) and greater trade openness (via lower export prices) may lead to job losses or gains, albeit in different regions. Rodrik (1997), Kapstein (2000) and others suggest that redistributive social measures are crucial to ensure that both the benefits and costs of trade are shared equitably within countries. Our findings concur with these recommendations, but also indicate that social policy measures need

to take into account regional differences in the inequality-enhancing effects of international trade.

## NOTES

<sup>1</sup> “Urban” refers to counties located in metropolitan areas of the United States. As defined by the U.S. Census, metropolitan areas consist of one or more contiguous counties in which at least one county contains a city of 50,000 or more inhabitants (U.S. Bureau of the Census 1998). “Rural” refers to those counties that are not part of a metropolitan area. The terms “rural” and “nonmetro” are used interchangeably, as are the terms “urban” and “metro.”

<sup>2</sup> The Appalachian region of the United States includes 399 counties located in portions of 13 states. Appalachia is primarily rural, and it is among the poorest regions of the United States.

<sup>3</sup> Foreign export shipment data by firm are available beginning in 1983.

<sup>4</sup> The county-level trade database remains at the Washington, DC, Census RDC and will be made available for use by other researchers.

<sup>5</sup> The exchange rates are nominal exchange rates deflated by GDP deflators in foreign currency per U.S. dollar normalized to be 100 in 1993. 1993 was selected as a base year because GDP data was the most complete for all countries in the data set during this year.

<sup>6</sup> Due to a lack of industry export data in earlier years, we used weights based on the 1987 Census for the years from 1972-1989; weights based on the 1992 Census were used for the years 1990-1994.

<sup>7</sup> Weights are based on Manufacturing Censuses, performed every five years. Each census is used to weight the data for the Census year and for the two years before and the two years after the Census. So for example, the 1977 Census data was used to weight county import exchange rate data for 1975, 1976, 1977, 1978, 1979. The dataset is missing counties in Rhode Island due to a coding problem in the LRD. It also excludes counties with no manufacturing establishments.

<sup>8</sup> International trade data compiled on a consistent 4-digit SIC level using 1972 SIC definitions is currently available for the period from 1972 through 1994 (Feenstra, 1996, 1997).

<sup>9</sup> Processed agricultural products, which are highly concentrated in rural areas, are included as part of the manufacturing food products sector (SIC 20). Comparable national and regional time series data for trade and regional production of raw agricultural products and services are not currently available.

<sup>10</sup> The figures on the export and import share of total U.S. trade are calculated using data from the U.S. international trade administration from 2002 (International Trade Administration 2003). Manufactured export and import shares of total U.S. trade remained relatively constant between 1995 (the last year of the study period) and 2002 (International Trade Administration 2003).

<sup>11</sup> Use of a lagged endogenous variable is common in regional employment panel studies where present period variables are strongly related to historical conditions (e.g., Blanchard and Katz, 1992; Henderson, 1994; Leichenko, 2000). In such studies, the lagged endogenous variable provides a proxy for “base year” effects in the context of panel estimation and is analogous to inclusion of a base year in a standard cross-sectional, regional growth model.

<sup>12</sup> The expected sign on the exchange rate coefficients depends, in part, on how the exchange rate variables are constructed. Because we use U.S. dollars/foreign currency, an increase in our exchange rate implies that each U.S. dollar is worth less relative to foreign currency, and hence implies that U.S. exports are relatively cheaper for foreigners to purchase.

<sup>13</sup> The Census regions are multistate regions defined based on homogeneity of states in terms of economic characteristics, particularly industrial structure. They include New England (Region 1), MidAtlantic (Region 2), Southeast (Regions 3), Great Lakes (Region 4), Southcentral

(Region 5), Great Plains (Region 6), Mountain West (Region 7), Southwest (Region 8), West Coast (Region 9).

<sup>14</sup> Each of these tests is intended to improve the specification of the models. The unit root and cointegration tests, which are derived from tests for autocorrelation, look for evidence of common trends in the data series. The lag length tests help to determine the appropriate number of past years to include in the model.

<sup>15</sup> Each of the tests was performed on 30 different groupings of observations for both the employment and earnings models. These groupings include: 3 groupings for the U.S. as whole including all counties, all urban counties, all rural counties; and 27 groupings for the nine census regions, including all counties in each region, all urban counties in each region, and all rural counties in each region. For employment, in 24 out of the 30 groupings there was no evidence of unit roots. For earnings, in 28 out of 30 groupings, there was no evidence of unit roots. In the employment model, unit roots were found in the model for all counties in Census region 4 (Great Lakes), in the urban county models in Census regions 6 and 7 (Great Plains, and Mountain West respectively), and in the all county and rural county models in Census region 9 (West Coast). Each of these models was run in first differences, except the all county model for Census region 9, which also displayed evidence of cointegration and hence was estimated in levels. Among the earnings models, the rural county models in Census regions 1 and 2 (New England and MidAtlantic) displayed evidence of unit roots, but not cointegration. These models were estimated in first differences. Results of the unit root and cointegration tests are available from the authors.

<sup>16</sup> Results of the lag length tests are available from the authors.



<sup>17</sup> Use of fixed effects controls for locational factors that are common to counties in the same region, but does not address input-output type linkages between counties.

<sup>18</sup> The values of the exogenous (explanatory variable) coefficients may be slightly biased downward as the result of the inclusion of the lagged endogenous variables in the models. Hsaio (1986) has addressed this issue in the context of fixed effects, OLS estimation and has found that when  $t$  is small (i.e., when there are only a few years included the panel) there will be a downward bias in the value of the exogenous coefficients and an upward bias in the value of the lagged endogenous coefficient. As  $t$  becomes larger, however, Hsaio finds that these biases approach zero. In the present study, the value of  $t$  is 23 (i.e., there are 23 years of data in the panel), which constitutes a relatively long panel. Any downward bias in the exogeneous coefficients is thus likely to be very modest.

<sup>19</sup> Evidence on the effects of higher steel prices associated with recent tariff increases suggest that such tariffs have cost many jobs in steel purchasing industries (*Wall Street Journal* 2003). Higher prices for imported inputs may have a similar effect on input-consuming producers.

<sup>20</sup> Bardhan and Howe (2001), which extends upon Feenstra and Hanson (1996), help to account for the limited and mixed effects of imports suggesting that employment declines due to international outsourcing vary by sector and tend to be concentrated in industries experiencing declines in overall sales.

<sup>21</sup> Results for the combined models by Census region were similar to the urban models. These results are available from the authors.

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Table 1. Population and Manufacturing Employment by Census Region, 1995.

Census Region	Total Population	Rural Population	Rural Population Share	Total Manuf. Employment	Total Rural Manuf. Employment	Rural Share of Manuf. Employment
U.S.	258,954,909	52,759,177	20%	19,062,452	4,471,274	23%
NewEng	13,282,700	2,024,942	15%	1,094,032	170,172	16%
MidAtlan	43,903,146	3,843,038	9%	2,703,957	287,199	11%
SouthEas	39,165,980	9,321,145	24%	2,815,190	949,567	34%
GreatLks	43,629,122	8,946,986	21%	4,428,891	941,320	21%
SouthCen	22,858,034	9,343,952	41%	2,009,562	1,001,652	50%
GreatPlns	18,362,798	7,503,226	41%	1,517,687	591,872	39%
MtnWest	8,226,804	2,962,671	36%	450,986	124,685	28%
SouthWst	27,934,578	5,663,368	20%	1,510,444	230,971	15%
WestCst	41,591,747	3,149,849	8%	2,531,703	173,836	7%

Source: U.S. CENSUS (2001) Regional Economic Information System, 1969–1999, cd-rom; authors' calculations.

Table 2. County manufacturing employment changes over the study period.

Census Region	All Counties			Rural Counties			Urban Counties		
	Manuf. Employment in 1972	Manuf. Employment in 1995	Manuf. Employment, Change, 1972-1995	Manuf. Employment in 1972	Manuf. Employment in 1995	Manuf. Employment, Change, 1972-1995	Manuf. Employment in 1972	Manuf. Employment in 1995	Manuf. Employment, Change, 1972-1995
U.S.	19,220,379	19,062,452	-1%	3,678,374	4,471,274	22%	15,542,005	14,591,178	-6%
NewEng	1,371,759	1,094,032	-20%	166,135	170,172	2%	1,205,624	923,860	-23%
MidAtlan	4,229,790	2,703,957	-36%	330,456	287,199	-13%	3,899,334	2,416,758	-38%
SouthEas	2,418,330	2,815,190	16%	843,524	949,567	13%	1,574,806	1,865,623	18%
GreatLks	4,962,898	4,428,891	-11%	775,235	941,320	21%	4,187,663	3,487,571	-17%
SouthCen	1,688,044	2,009,562	19%	766,954	1,001,652	31%	921,090	1,007,910	9%
GreatPlns	1,249,563	1,517,687	21%	387,850	591,872	53%	861,713	925,815	7%
MtnWest	273,291	450,986	65%	79,101	124,685	58%	194,190	326,301	68%
SouthWst	1,028,621	1,510,444	47%	177,104	230,971	30%	851,517	1,279,473	50%
WestCst	1,998,083	2,531,703	27%	152,015	173,836	14%	1,846,068	2,357,867	28%

Source: U.S. CENSUS (2001) Regional Economic Information System, 1969–1999, cd-rom; authors' calculations.

Table 3. County manufacturing earnings changes over the study period.

Census Region	All Counties			Rural Counties			Urban Counties		
	Real Manuf. Earnings/ Worker in 1972	Real Manuf. Earnings/ Worker in 1995	Real Manuf. Earnings/ Worker, Change, 1972-1995	Real Manuf. Earnings/ Worker in 1972	Real Manuf. Earnings/ Worker in 1995	Real Manuf. Earnings/ Worker, Change, 1972-1995	Real Manuf. Earnings/ Worker in 1972	Real Manuf. Earnings/ Worker in 1995	Real Manuf. Earnings/ Worker, Change, 1972-1995
U.S.	21,857	27,913	28%	20,055	24,863	24%	26,448	36,088	36%
NewEng	24,414	33,580	38%	22,500	29,739	32%	26,776	38,316	43%
MidAtlan	26,904	36,463	36%	23,715	30,090	27%	28,893	40,438	40%
SouthEas	19,556	27,406	40%	17,878	24,462	37%	22,722	32,910	45%
GreatLks	26,269	33,464	27%	23,758	29,830	26%	31,004	40,488	31%
SouthCen	19,262	26,700	39%	17,786	24,355	37%	24,343	34,940	44%
GreatPlns	20,301	23,951	18%	19,417	22,664	17%	26,219	33,296	27%
MtnWest	21,826	23,312	7%	20,895	22,003	5%	29,321	35,090	20%
SouthWst	20,180	26,075	29%	19,084	23,978	26%	23,347	32,947	41%
WestCst	28,681	31,325	9%	28,052	28,109	0%	29,560	36,038	22%

Source: U.S. CENSUS (2001) Regional Economic Information System, 1969–1999, cd-rom; authors' calculations.

Table 4. Regression coefficients for manufacturing employment and manufacturing earnings models for all rural counties, urban counties, and all counties combined (t-statistics in parentheses).

<b>Dependent</b>	Employment <sub>t</sub>			Earnings <sub>t</sub>		
<b>Explanatory</b>	<i>Rural</i>	<i>Urban</i>	<i>All</i>	<i>Rural</i>	<i>Urban</i>	<i>All</i>
Employment <sub>t-1</sub>	.9070** (214.1)	.9660** (228.4)	.9273** (298.6)	—	—	—
Earnings <sub>t-1</sub>	—	—	—	.8298** (273.2)	.9332** (344.2)	.8699** (400.2)
Pop_dens <sub>t-1</sub>	.1786** (24.1)	.0795** (10.5)	.1493** (27.3)	.1348** (50.2)	.0562** (23.4)	.1058** (55.1)
Manuf_shar <sub>t-1</sub>	-.0882** (-2.7)	-.2747** (-8.7)	-.1599** (-6.7)	.1065** (9.6)	-.0031 (-0.3)	.0707** (8.5)
Export_exch <sub>t-1</sub>	.0002** (6.7)	.0002** (7.3)	.0002** (9.2)	7.0E-5** (4.3)	4.3E-5** (2.2)	6.0E-5** (4.7)
Import_exch <sub>t-1</sub>	.0002** (4.0)	-.0002** (-5.3)	-.0001* (-1.8)	.0003** (8.6)	5.8E-5** (3.3)	.0001** (7.8)
Export_orient <sub>t-1</sub>	-.0612** (-5.1)	-.0786** (-5.1)	-.0639** (-6.8)	-.0014** (-0.2)	-.0369** (-4.5)	-.0098* (-1.8)
Import_orient <sub>t-1</sub>	-.0042 (0.3)	-.0226** (-2.3)	-.0255** (-3.0)	.0339** (4.3)	.0043 (0.8)	.0102** (2.1)
County fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Adjusted R <sup>2</sup>	.99	.99	.99	.99	.99	.99

Source: Authors' calculations at Center for Economic Studies, U.S. Census Bureau.

\*\*Statistically significant at the .05 level.

\*Statistically significant at the .01 level.

Table 5. Sign and statistical significance of regression coefficients for manufacturing employment models for rural and urban counties in each Census region.

	Rural Counties									Urban Counties								
<b>Dependent</b>	Employment <sub>t-1</sub>									Employment <sub>t-1</sub>								
<b>Explanatory</b>	<i>NE</i>	<i>MA</i>	<i>SE</i>	<i>GL</i>	<i>SC</i>	<i>GP</i>	<i>MW</i>	<i>SW</i>	<i>WC<sup>a</sup></i>	<i>NE</i>	<i>MA</i>	<i>SE</i>	<i>GL</i>	<i>SC</i>	<i>GP<sup>a</sup></i>	<i>MW<sup>a</sup></i>	<i>SW</i>	<i>WC</i>
Employment <sub>t-1</sub>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pop_dens <sub>t-1</sub>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Manuf_shar <sub>t-1</sub>	+	-	-	-	+	-	-	+	-	+	+	-	-	-	-	+	-	-
Export_exch <sub>t-1</sub>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Import_exch <sub>t-1</sub>	-	+	+	+	+	+	+	+	+	-	-	-	-	+	+	-	-	-
Export_orient <sub>t-1</sub>	+	-	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-
Import_orient <sub>t-1</sub>	+	+	+	-	+	-	-	-	+	-	-	-	-	-	-	+	-	-

Source: Authors' calculations at Center for Economic Studies, U.S. Census Bureau.

\*\*Statistically significant at the .05 level.

\*Statistically significant at the .10 level.

<sup>a</sup>Model estimated in first differences.

Table 6. Sign and statistical significance of regression coefficients for manufacturing earnings models for rural and urban counties in each Census region. (Lag with the largest coefficient for each variable is in **bold**.)

	Rural Counties									Urban Counties								
<b>Dependent</b>	Earnings <sub>t</sub>									Earnings <sub>t</sub>								
<b>Explanatory</b>	<i>NE<sup>a</sup></i>	<i>MA<sup>a</sup></i>	<i>SE</i>	<i>GL</i>	<i>SC</i>	<i>GP</i>	<i>MW</i>	<i>SW</i>	<i>WC</i>	<i>NE</i>	<i>MA</i>	<i>SE</i>	<i>GL</i>	<i>SC</i>	<i>GP</i>	<i>MW</i>	<i>SW</i>	<i>WC</i>
Earnings <sub>t-1</sub>	-	+	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **
Earnings <sub>t-2</sub>	+	-	+	-	<b>+</b> **	<b>+</b> *	-	+	+	-**	-*	<b>+</b> *	-**	-**	+	-	-	+
Earnings <sub>t-3</sub>	<b>+</b>	-	-	-**	-	-	+	-	+	-**	-	+	<b>+</b> **	-	-	-	-**	-
Pop_dens <sub>t-1</sub>	+	<b>+</b> **	<b>+</b> **	<b>+</b> **	<b>+</b> **	+	<b>+</b> **	<b>+</b>	+	<b>+</b> **	<b>+</b> **	<b>+</b> **	+	+	-	<b>+</b> *	+	<b>+</b> **
Pop_dens <sub>t-2</sub>	<b>+</b>	+	-	-	-	-	-**	+	<b>+</b>	-**	+	-	<b>+</b>	<b>+</b>	<b>+</b>	-	-	-*
Pop_dens <sub>t-3</sub>	+	-**	+	+	+	<b>+</b> *	<b>+</b> **	-	-	<b>+</b> *	-	+	-	-	+	+	+	<b>+</b> *
Manuf_shar <sub>t-1</sub>	-*	-**	-*	+	+	<b>+</b> **	+	<b>+</b> **	<b>+</b> **	-	-	<b>+</b> *	-**	-**	-**	<b>+</b> **	<b>+</b> **	+
Manuf_shar <sub>t-2</sub>	<b>+</b> *	<b>+</b> **	<b>+</b> *	<b>+</b> *	<b>+</b> **	-	<b>+</b>	+	-	-	+	-	-**	<b>+</b> **	<b>+</b> **	-	-**	<b>+</b>
Manuf_shar <sub>t-3</sub>	-*	-	-	-	-	+	-	-*	-	+	-*	-	<b>+</b> **	-**	-**	+	+	-
Export_exch <sub>t-1</sub>	<b>+</b>	+	+	+	+	-	-	<b>+</b> **	-	-	+	-	+	+	+	+	<b>+</b> *	+
Export_exch <sub>t-2</sub>	+	-	+	-	+	<b>+</b>	+	-	<b>+</b>	-	-	<b>+</b>	<b>+</b>	+	+	-	+	+
Export_exch <sub>t-3</sub>	-	<b>+</b> **	-	+	+	+	-	+	+	+	+	+	-*	-	-*	+	-*	+
Import_exch <sub>t-1</sub>	<b>+</b> **	+	-*	+	-	+	<b>+</b> **	+	<b>+</b> **	-	-	+	-	+	-	+	+	-
Import_exch <sub>t-2</sub>	+	+	<b>+</b> **	-	+	+	<b>+</b> **	+	-	-	+	-	<b>+</b> *	-	+	+	+	+
Import_exch <sub>t-3</sub>	-	+	-	<b>+</b> **	+	+	-	+	-	+	+	+	-	-	-	-	+	-
Export_orient <sub>t-1</sub>	-	-	+	+	+	-	+	-**	+	-	+	+	+	-	-*	-	-**	-
Export_orient <sub>t-2</sub>	+	-	-	-	-	-	-	<b>+</b> *	-	-	+	-	-*	+	-	<b>+</b> *	+	+
Export_orient <sub>t-3</sub>	-	-**	+	+	-**	+	+	+	-	+	-	+	+	-	+	-**	-	-*
Import_orient <sub>t-1</sub>	+	-	-	+	+	+	-	+	+	<b>+</b>	+	<b>+</b> *	<b>+</b> **	+	-	+	-**	+
Import_orient <sub>t-2</sub>	+	-	+	+	+	-	-	-	+	-	+	-*	-*	-	+	-	+	-
Import_orient <sub>t-3</sub>	<b>+</b>	-	+	-	<b>+</b> **	+	+	+	+	-	-	-	<b>+</b> *	<b>+</b> *	+	+	-	+

Source: Authors' calculations at Center for Economic Studies, U.S. Census Bureau.

\*\*Statistically significant at the .05 level

\*Statistically significant at the .10 level.

<sup>a</sup> Model estimated in first differences.

## Figure captions

Figure 1. Manufacturing employment growth (percentage change) across Census regions, 1972–1995. Source: U.S. CENSUS (2001) Regional Economic Information System, 1969–1999, cd-rom; authors' calculations.

Figure 2. Growth in real manufacturing earnings per worker (percentage change) across Census regions, 1972–1995. Source: U.S. CENSUS (2001) Regional Economic Information System, 1969–1999, cd-rom; authors' calculations.





